

# Uses of Gold in Electronics and its extraction

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## Abstract

Tokyo is due to host the 2020 Olympic Games and organizers have made plans to produce the gold and silver medals from e-waste. It is believed that e-waste in Japan alone makes up to 16% of the current gold reserve. This is a compelling incentive for sustainable metal sourcing. The precious metal is a key component of the printed circuit boards found inside electrical devices. It is extracted in different methods which are with using toxic and non-toxic chemical process.

*Keywords: Tokyo, e-waste, gold, Eco-friendly.*

## I. Introduction

Tokyo 2020 Olympics: Medals to be made from mobile phones. Organizers hope to gather eight tones of metal to create the two tons of gold, silver and bronze required for medals. The Japanese public will be asked to donate old phones and small appliances to gather two tons of metals for 5,000 medals." A project that allows the people of Japan to take part in creating the medals is really good," said Tokyo 2020 sports director Koji Murofushi. "There's a limit on the resources of our earth, so recycling these things will make us think about the environment." Members of Japan's Olympic organizing committee tabled the idea to government officials and companies in 2016. Olympic host cities have traditionally obtained the metal from mining firms. But Japan, which lacks its own mineral resources, is keen to take the theme of a sustainable future a step further.

## II. Structure

It is believed that e-waste in Japan alone makes up to 16% of the current gold reserve. Gold is used in connectors, switch and relay contacts, soldered joints, connecting wires and connection strips. This includes cell phones, calculators, personal digital assistants, global positioning system (GPS) units, television sets and other small electronic devices. Edge connectors used to mount microprocessor and memory chips onto the motherboard and the plug-and-socket connectors used to attach cables all contain gold. Gold recovery from discarded electronics devices could help reduce environmental impact of gold mining and cut carbon dioxide emissions. Estimated 300 tons of gold used in electronics each year, researchers say. Gold in these can be obtained by the following two major methods.

- a. Extraction with using toxic chemicals.
- b. Extraction without using toxic chemicals.

### 2.1 Extraction with using toxic chemicals

We have three different methods to extract precious metals from mobile phone waste. The gold from motherboards and connectors can be removed through a cyanide recovery process. Cyanide recovery process is quite economical and, we get complete recovery of gold through this, but cyanide being a very harmful chemical should be handled with care and it should be neutralized after the use. To remove gold through cyanide gold recovery process, firstly water is boiled in a steel container or Teflon plastic vessel. Motherboard is immersed in hot water. The amount of cyanide that is dissolved in water depends on the weight of the scrap and the quantity of water that is used. Then commercial grade sodium cyanide is used instead of potassium cyanide. Suppose in 10 kilograms of motherboards and 15 litres of water, then 50 grams of sodium cyanide is added to the water. Cyanide is dissolved into the water, and later on, again cyanide is added to the water if

needed. The more the oxygen in the solution the better will be the dissolution of gold in the cyanide solution. To maintain the strong presence of Oxygen in cyanide solution different type of Oxygen pumps are used. Once the gold is completely removed from the motherboard, the boards are taken out of the solution and the solution is filtered with the help of a filter paper. The gold from the cyanide solution can be easily separated by adding zinc dust to it.

## 2.2 Extraction without using toxic chemicals (Eco-friendly process).

Extracting gold from electronics may ultimately have a net positive effect but the recycling process is no simple matter. Unfortunately, recycling gold from electronics usually requires toxic chemicals such as mercury and cyanide. But a team of researchers from the University of Edinburgh has developed a method for gold extraction without the use of toxic chemicals. Their method involves using a mildly acidic solution to dissolve all the metal in the electronic waste and then adding an oily liquid so that only the gold is extracted. Such a process may allow extraction of precious metals without the use of toxic chemicals. This is a step that could help metals recycling become mainstream without risking further harm to the environment. In light of the dangers present, researchers are constantly searching for ways to curtail the potential damage of chemical gold extraction. One of the most interesting of these methods involves the use of fungi to filter out gold from handsets and other electronics.

## III. Use of Eco-Friendly E-waste Recycling (Methodology)

- According to the report, 1 metric ton of cell phone handsets could yield 340 grams of gold — enough to bring in a sizable profit for anyone with the proper resources for handling large-scale recycling and extracting precious metals from mobile phones.
- An average handset contains only about 24 milligrams of gold. It takes a ton of Gold ore to get 1g of gold. But you can get the same amount from recycling the materials in 41 mobile phones.
- Some 7.4 tons of gold is mined per day - if we got it from phones we'd run out of them in 23 days.
- Two hundred laptops would yield five troy ounces of gold.
- A PC circuit board, where the gold is, weighs about a pound. A ton of those boards, we should have 5 troy ounces of gold.
- In very rough numbers, there are 10 troy ounces of gold (or about three-fifths of a pound) per ton of smartphones. Ten thousand phones weigh one ton. [With gold selling for about \$1,580 per ounce that would yield \$15,800.]

Medals	London (2012)	E-Waste in Japan (2014)
Gold	9.6 kg	143 kg
Silver	1,210 kg	1,566 kg
Copper (Bronze)	700 kg	1,112 kg

Table 1. The amount of metals needed to make the medals for the Olympic Games could easily be met using recycled e-waste from Japan.

## 4. Conclusion

The electronics industry produces up to 42 million tons of waste annually, which is becoming a problem with precious metals such as gold and palladium becoming increasingly rare and expensive. It is also believed that up to 90% of the world's electronics waste (worth \$19 billion), is dumped and traded illegally. This dumping of e-waste has cost \$52 billion to the global economy. Furthermore, practices such as planned obsolescence do

not help with reduction of waste if a phone or computer becomes outdated in just a few years. Tokyo is due to host the 2020 Olympic Games and organizers have made plans to produce the gold and silver medals from e-waste. This is a compelling incentive for sustainable metal sourcing.

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